

## ORIGIN OF HUMAN CLONING

Parth Arora

Scottish High International School, Gurugram

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### ABSTRACT

It is a well-known fact that the inquisitive nature of people has given birth to various revolutionary discoveries just as Human Cloning. Once considered a concept of science fiction, the replication and regeneration of species turned into reality. The arrival of Dolly, a cloned sheep in 1997 had become a hot discussion topic in the world giving rise to various legal, social and ethical aspects of cloning. Different dignitaries in the field of clinical sciences hold assorted, diverse and strong opinions about human cloning. This paper centers around the origin and evolution of this revolutionary subject, Cloning. Various types of cloning, stem cell regeneration and its significance along with pros and cons are focussed.

**Keywords:** Human cloning, ethical aspects, stem cell regeneration.

### Introduction

Human cloning is the formation of a hereditarily indistinguishable or identical duplicate (or clone) of a human. The term cloning (originated from the Greek word klon, a twig or slip) is by and large used for artificial human cloning, which is the generation of human cells and tissue that does not include any natural process of conception and reproduction of identical species. Natural cloning has been observed in the asexual reproduction method which is found in single-celled organisms. Many reptiles, bees, fishes, and ants adopt this process of asexual reproduction. It is the natural process of reproduction also observed in many plants. The best example of natural cloning is the formation of a runner from a strawberry plant which grows into a new plant. However, artificial cloning also can not be considered a completely new concept. For many years Farmers and gardeners have been practising the method of cutting small shoots from plants and rooting them in soil for the production of the same new species of that plant. This method can also be considered artificial cloning. but, the term "Human cloning", is the biotechnological replication of human organisms. (The Witherspoon Council,2015).

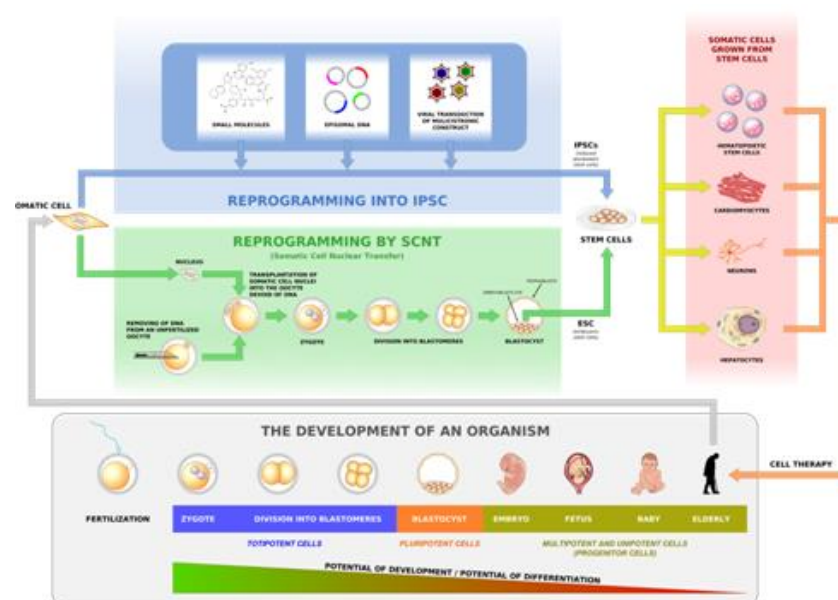
## History and origin of cloning

The evolution of cloning Technology underwent through five separate periods - (1) The fiction period (1818-1961) (2)Frog cloning(1962- 1977) (3) IVF and Mammal cloning (1978- 1993) (4) Twinning (1993-1996) and (5) Sheep renucleation from an adult cell (1997 –) (Humber, Almeder,1998). The term “Human Cloning” received ample attention in the 20th century, however, it was first introduced by scientist J. B. S. Haldane in 1963, while addressing the Ciba Foundation on the topic "Biological Possibilities for the Human Species of the Next Ten Thousand Years”. Many researchers and biologists like Leon Kass, and James D. Watson had used this term as a subject of their research and publication. The debates and advocacy on the potentials and perils of artificial cloning had become a burning topic of discussion. Many researchers started their innovative experiments of artificial cloning with frogs, toads and other amphibian embryos in the 1970s.

After the successful artificial cloning of the first mammal, **The sheep ‘Dolly’**, in 1996, by the Roslin Institute Scotland, the possibility of human cloning turned into a burning topic of discussion. After that few researchers claimed to produce human clones in recent years.

In November 1998, the first hybrid human clone was developed using Advanced Cell Technology, a nucleus from a man's leg cell was embedded into a cow's egg from which the nucleus had been removed. The hybrid cell then was cultured into an embryo, which was destroyed later.

**Figure 1 : Diagram of the ways to reprogram cells along with the development of humans.**



## **Types of human cloning:**

### **(1). Therapeutic cloning:**

The cloning of cells from a human for use in medicine and transplants is referred to as therapeutic cloning. The eggs are formed into cells i.e. embryos which results in the development of embryonic stem cells. These cells can be naturally created through the fertilization process to make different parts of the body. Development of embryos refrains further and stem cells are used for medical purposes. Biologically compatible cells which are suitable for the immune system of the body are reproduced through cloning methods. These cells are converted into organs that can be used for the transplantation of malfunctioning organs. This can cure diseases caused due to damaged cells. Many heart diseases can be treated by transplanting heart cells, nerve cells can be treated in cases of Huntington's disease, Alzheimer's disease, Parkinson's disease, multiple sclerosis etc. Blindness can be cured with the restoration of photoreceptor cells.

In 1908, The term "Stem Cell" was first introduced by Russian-American embryologist Alexander Maksimov. He portrayed that the stem cells present in the bone marrow of grown-ups or adults can be transformed into blood Cells. Later, British biologists Martin Evans and Matthew Kaufman along with American biologist Gail Martin found the method of stem cell extraction from mice. (Klus, 2014)

### **(2). Reproductive cloning:**

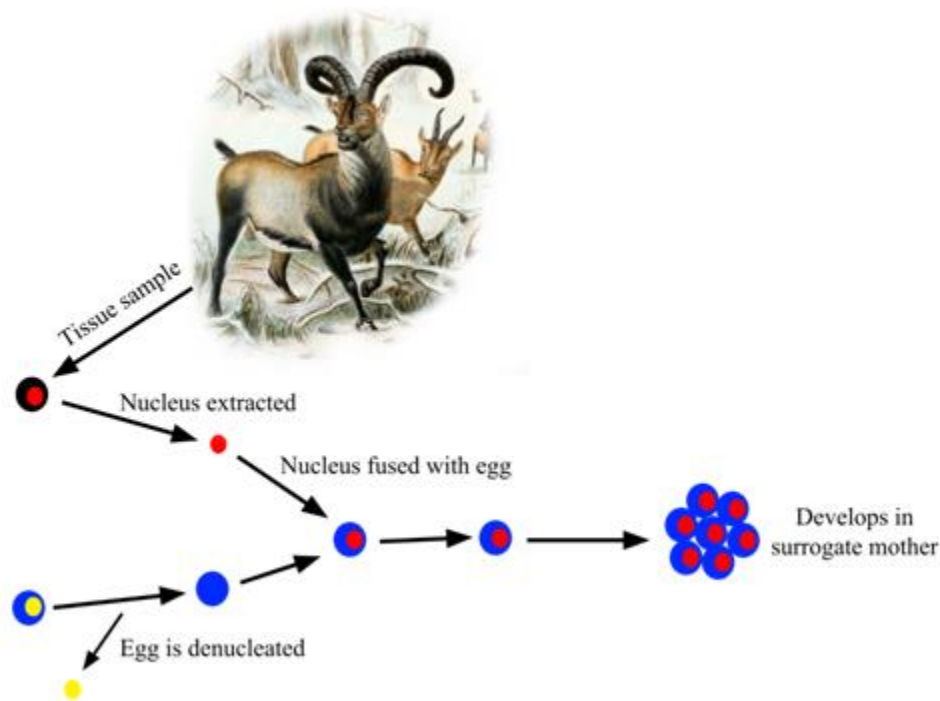
It includes the generation of entirely cloned humans, rather than the generation of specific stem cells or tissues. In this method, the egg is naturally developed in the surrogate mother who eventually gives birth to a nearby genetically similar person. However, since some DNA from the egg donor remains outside the nucleus of the egg wall, producing completely identical offspring is difficult.

Due to the impact of the environment where we grow, in spite of being genetically identical, some physical or mental changes may be observed in identical twins as well. reproductive cloning can be useful in many ways. Just like the way we clone plants, animals with positive characteristics, like lean meat, can be cloned to deliver food. Endangered and extinct species can be preserved and reproduced through reproductive cloning.

There is additionally a business opportunity for cloned pets, and creatures like horses, cats, or dogs whom we find especially appealing. Scientific research also has a huge demand for cloned animals as a subject of experiment, as their response to various chemicals are uniform. They can be used as a source of organ regeneration for their biological parents. American biologists Briggs and King cloned the first animal i.e. frog using nuclear transfer, in 1952. In 1958, British

biologist John Gurdon cloned a tadpole. In 1963, the first fish was cloned by Chinese embryologist Tong Dizhou. Later, in 1996, the first mammal (i.e. a sheep called Dolly) was cloned by Ian Wilmut and Keith Campbell. It was the most revolutionary cloning in history. In 1998, the human somatic cells and cow's eggs were utilized to produce the hybrid clone, which was destroyed after 12 days. Many animal species like goats, cows, pigs, and mice have been cloned since the late 1990s. In 2001, the gaur (a type of Ox) was cloned as the first endangered species. These all animals were cloned with the infusion of egg donors and surrogate mothers of similar species. (Refer to figure 2.)

**Figure 2 : The process used to clone a bucardo in 2009**



**Methods used for therapeutic cloning:**

The following are the two most widely used methods of therapeutic cloning -

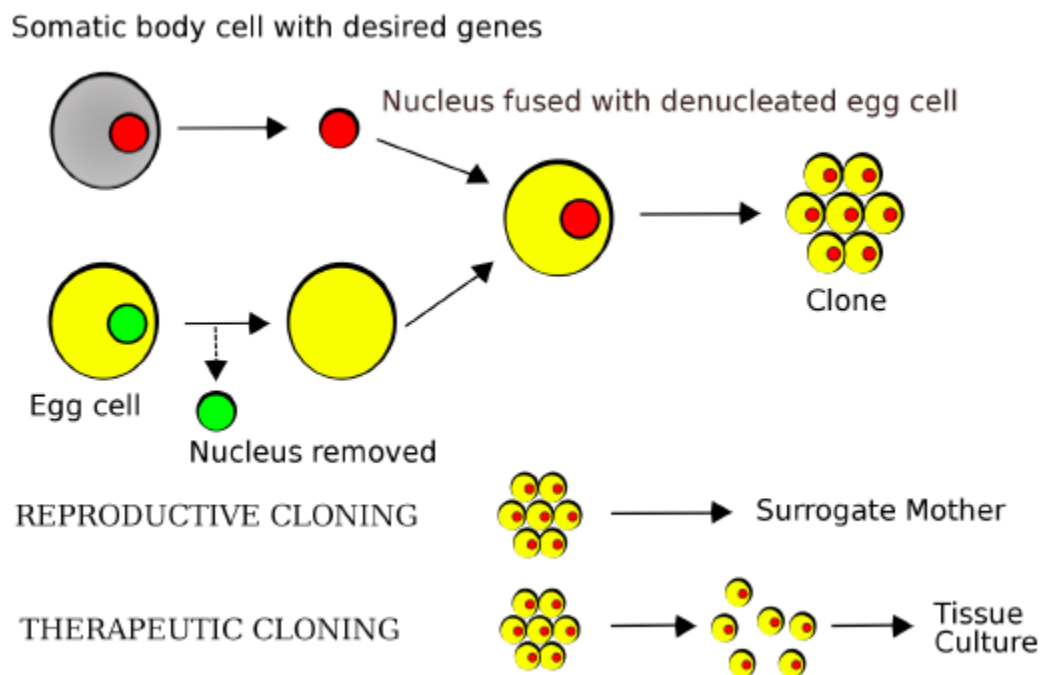
- a). Somatic-cell nuclear transfer (SCNT)
- b). Induced pluripotent stem cell induction (iPSCs)

**a). Somatic-cell nuclear transfer (SCNT):**

In somatic cell nuclear transfer ("SCNT"), the nucleus of a somatic cell is taken from a donor or

the animal to be cloned and transplanted into a host egg cell, which had its own nucleus removed previously, making it an enucleated egg. This egg then contains a nucleus with two sets of chromosomes, and they are all identical to the animal you took them from (Klus, 2014). (Refer to figure 3) The first successful clone of the animal was created by British biologist John Gurdon in 1958. In 1984, Danish embryologist Steen Willadsen redefined this cloning technique, and without physically removing the somatic cell, the two cells were infused together using a small electric current. The newly fused cell is then allowed to grow in a surrogate or developed artificially. Cloned sheep Dolly, was developed by using the SCNT method of cloning.

**Figure 3: A diagram of the SCNT Process. Image credit: Wikibob/Schorschski/Dr Jürgen Groth/CC SA**



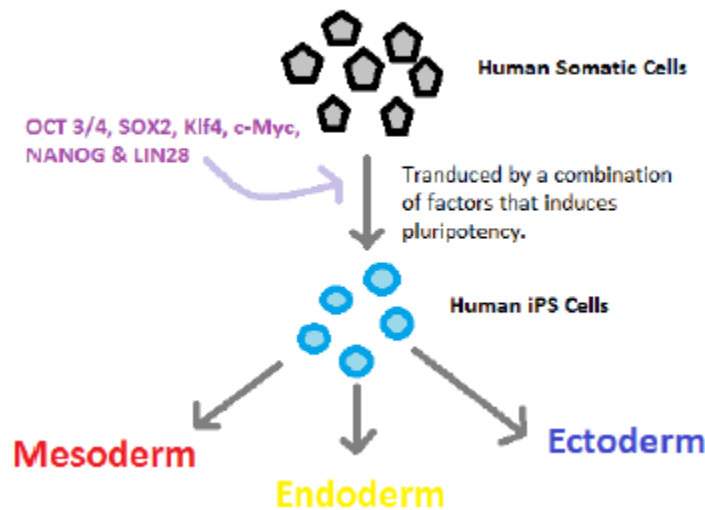
**(b). Induced pluripotent stem cell induction(iPSCs):**

In 2006, Japanese scientists Kazutoshi Takahashi and Shinya Yamanaka found a better approach to produce stem cells without utilizing donated eggs or the creation and destruction of embryos. It was found that when physical cells are embedded with four explicit quality genes, they can be reprogrammed into embryo-like stem cells. These were named induced pluripotent undifferentiated organisms (iPSCs). Refer to figure 4.

Pluripotent means that the stem cells can possibly turn out to be any cell in the body; the adult stem cells which are not pluripotent can only turn into a particular sort of specific cell. For

instance, bone marrow stem cells can be developed in any type of platelet, yet they can't be converted into any other cell. Here the term “ induced” is used to indicate the difference between these stem cells and naturally pluripotent embryonic stem cells. However, iPSCs can't be used to treat mitochondrial diseases; those stem cells can be produced using SCNT.

**Figure 4: Overview of iPS cells**



**Pros of Cloning:**

After the successful cloning process in 1996, cloning has been identified as a revolutionary field in biotechnology. The pros of cloning are as follows:

**1). Prevent the extinction of species:**

Many rare species which are approaching endangerment and extinction can be restored or saved by regenerating their genes through the cloning process. This can also help researchers and scientists to study and research these rare species as living organisms.

**2). Increased food production:**

Increased agricultural production can be attained using cloning. Cloning can be used for fast replication of genes of interest as they can grow faster compared to the natural growth process. This fact can be helpful in improving food production.

**3). Help with infertility problems:**

Cloning is a boon for infertile and same-sex couples. Without donor eggs or sperms, children can

be produced through surrogacy, so same-sex couples can also have children through cloning. Infertile parents now also can expect their genetic traits in their children through genetic manipulation.

**Cons of cloning:**

**1). Lack of safety and accuracy in cloning:**

This method does not ensure identical behavioral attributes and physical appearance among genetically identical clones since genetic material is not the only determinant of these attributes. These techniques are not completely accurate and safe. It has been observed that most of the clones produced suffer from health issues and reduced age. For example, Dolly the sheep had been observed to possess abnormalities in her DNA.

**3). It can be an unethical and highly abusive process:**

Critics say that clone production can lead to the exploitation of the life of the organism being cloned. Scientists had to perform multiple attempts for performing this process which can be highly abusive for the living being undergoing the procedure.

**4). This technique is not fully developed yet:**

Even after continued scientific experiments this process is still not fully developed to promote cloning as a way of conserving species. As compared to cloning of domestic animals, and cattle, cloning of endangered species can be a more difficult, challenging, and time taking process. Even after performing cloning of endangered and extinct species many times, it is observed that attempts of producing exact copies of them are failed.

**Conclusion**

Researchers and scientists in general have various understandings of why is human cloning significant. Most researchers appear to think cloning is a promising though troublesome Strategy for studying genetics and formative science or creating cells and tissues that can be utilized for research or treating patients. Development of stem cells, with their appealing application of regenerative medication, the biomedical uses of cloning have come to spellbind the mind of a significant population. However, there are many moral and ethical concerns regarding obtaining stem cells through such a troubling technology. From one perspective, there might be significant public strategy troubles in carrying out any limitations on regenerative cloning that don't likewise restrict therapeutic cloning, as the underlying SCNT technique would be the same for the two purposes. On the other hand, it is possible that regenerative cloning will remain ethically impracticable since it will constantly be highly hazardous or excessively dangerous for future



developed species.

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